

The Role of Chemistry in Sanitization and Personal Hygiene in Context of Covid-19

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Received 16th May 2022,

Accepted 17th Jun 2022,

Online 23rd July 2022

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Abstract: Many in the chemistry community are making their contribution to the global fight against coronavirus by staying safely at home. Many of those will be able to work from home. And many others – often those designated as key workers by governments – are going into their labs, offices and other workplaces to carry on essential work. Chemists are helping to keep the lights on – literally. There are plenty of scientists whose jobs keep energy and electricity flowing to our houses, allowing those of us at home to communicate with distant colleagues and loved ones, educate our children with online learning support, and of course find light relief. Netflix is powered by chemistry.

They're also keeping water flowing in and out of our homes and hospitals. Science technicians are carefully monitoring and managing a clean and abundant water supply that supports everything: research, healthcare, and daily life. Imagine the prospect – as many millions face in India and other countries – of managing a pandemic when washing your hands is a luxury?

Of course, research and development has a critical role to play too – chemistry-based research institutions and companies of all sizes are refocusing their efforts towards discovering more about the virus, developing improved testing technologies, and eventually creating a vaccine. Many offer services or devices that already use cutting-edge chemical science to measure smaller samples, or achieve higher throughput. Chemistry is essential at every step of our response to the virus.

Key words: Sanitization, Covid-19.

Beyond research, technicians are providing the specialist skills needed to run tests, maintain equipment and manage laboratory supplies - including the donations of chemicals for hand san and safety equipment that are going straight to doctors and nurses on the front lines.

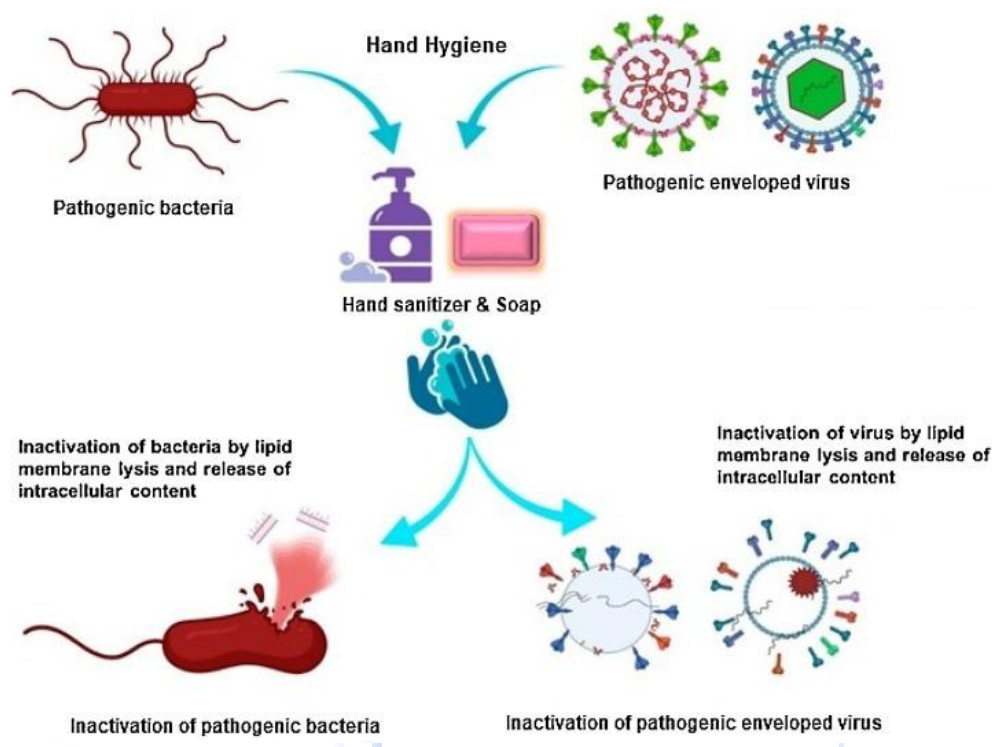
There are also many thousands of teachers still working hard to give their students an inspiring chemistry education, whether it's in classrooms or remotely. Using the latest technology and some innovative thinking they're ensuring that, despite a massively disrupted school routine, there will still be students going on to study and work in chemistry in the years to come.

We've been documenting the chemical science community's role in our global response to Covid-19 - from the science of healthcare for those with the virus, to the many people whose work keeps us warm, clean and informed as we stay physically distanced. Read more by following the links in the section below.

Introduction

Hand hygiene using soaps or hand sanitizers is the first-line defensive measure to fight against COVID-19. Soaps or detergents (chemical surfactants) are surface-active agents. They are synthesized from petrochemicals and act by reducing the surface and interfacial tension between two phases. Linear alkylbenzene sulfonates (LAS) having a chain length of C₁₀-C₁₄ are the most commonly used surfactants in soaps, detergents, shampoos, and personal care products. Handwashing facilities like the availability of water are required for maintaining hand hygiene by soaps/detergents.[1,2]

Hand sanitizers are popular as they can be carried easily and useful when handwashing facilities are not readily available. Not all sanitizers are effective and therefore, WHO has recommended the use of alcohol-based hand sanitizers which can be easily prepared for local production. The composition of WHO-recommended hand sanitizer formulations contains, either ethanol (96 %; final concentration 80 % v/v) or isopropyl alcohol (99.8 %; final concentration 75 %) along with hydrogen peroxide (0.125 % v/v as a preservative to inactivate bacterial spores) and glycerol (1.45 % v/v as a humectant – moisturizing agent) diluted with sterilized distilled water or boiled water. In commercial products, propylene glycol is being used as a humectant. A viscosity enhancer such as alkyl acrylate cross-polymer, tetrahydroxypropyl-ethylenediamine, etc. is usually added in alcohol-based hand-rub gels. The cost of alcohol-based liquid and gel sanitizers is ranged around US\$ 2.5–5.4 and US\$ 8, respectively. The mechanism of killing the microorganisms by soaps or detergents relies on the fact that they disrupt the lipophilic membrane of the cell wall of bacteria and other microorganisms including enveloped viruses. Similarly, alcohol also dissolves the lipid membrane of microorganisms. Literature suggests that ethanol is highly effective (within 30 s) against almost all clinically relevant enveloped viruses including coronaviruses (SARS-CoV i.e. Severe Acute Respiratory Syndrome Coronavirus and MERS-CoV i.e. the Middle East Respiratory Syndrome Coronavirus, which belong to the same class of viruses as SARS-CoV-2), and influenza viruses. Therefore, alcohol-based hand sanitizers with alcohol content >60 % v/v are popular and recommended by WHO and other national organizations such as CDC (Centers for Disease Control and Prevention), USA. The recent study by reports that SARS-CoV-2 was efficiently inactivated by ethanol and 2-propanol at a concentration of >30 % v/v and by the two preparations recommended by WHO in 30 s. That's why frequent hand washing with soaps and hand hygiene with alcohol-based hand sanitizers has been recommended. [3,4]



Discussion

Ethanol and isopropanol are the main alcohols used as disinfectants for a broad spectrum of bacteria, viruses, and fungi. The biocidal activity of these alcohols is dependent on their concentration and hydro affinity. The optimal concentration for antimicrobial activity is at 60–80% of alcohol where ethanol is superior to isopropanol against hydrophilic viruses, such as rotavirus, human immunodeficiency virus (HIV), and coronaviruses, while isopropanol is more active against lipophilic viruses, such as poliovirus and hepatitis A virus (HAV). Ethanol and isopropanol are capable of destroying coronavirus at 70–90% concentrations within 30 s. It is believed that the alcohol causes membrane damage and denaturing of virus's proteins in addition to damaging the RNA. The strong ability of these alcohols to form hydrogen bonding and their amphoteric nature allow them to disrupt the tertiary structure of proteins by disrupting the intramolecular hydrogen bonds within the structure. Peroxide-based disinfectants, such as hydrogen peroxide and peroxyacetic acid, target the oxidation of thiol groups and disulfide bonds of proteins and denature them. Hydrogen peroxide is virucidal at 1–3% concentrations and it can deactivate SARS-CoV within a minute; it is even more potent in the gas phase. The peroxyacetic acid is more active than hydrogen peroxide against a broad spectrum of pathogens and at lower concentrations (~0.3%); thus, it is frequently used to disinfect medical devices. Both peroxy compounds produce hydroxyl radicals that attack different parts of the virus including lipid membrane, proteins, and nucleic acids. These chemicals that are usually based on substituted phenols and bisphenols where the hydrogen atom on the aromatic ring is replaced by an alkyl group or a halogen. The high potency of these compounds granted them a major role in the disinfection of hospitals. Phenol derivatives can deactivate viruses, such as HIV, and other hydrophilic viruses within minutes at a concentration range of 0.5–5%. These compounds deactivate pathogens by inducing membrane damage which leads to leakage of intracellular components and denaturing of proteins. [5, 6]

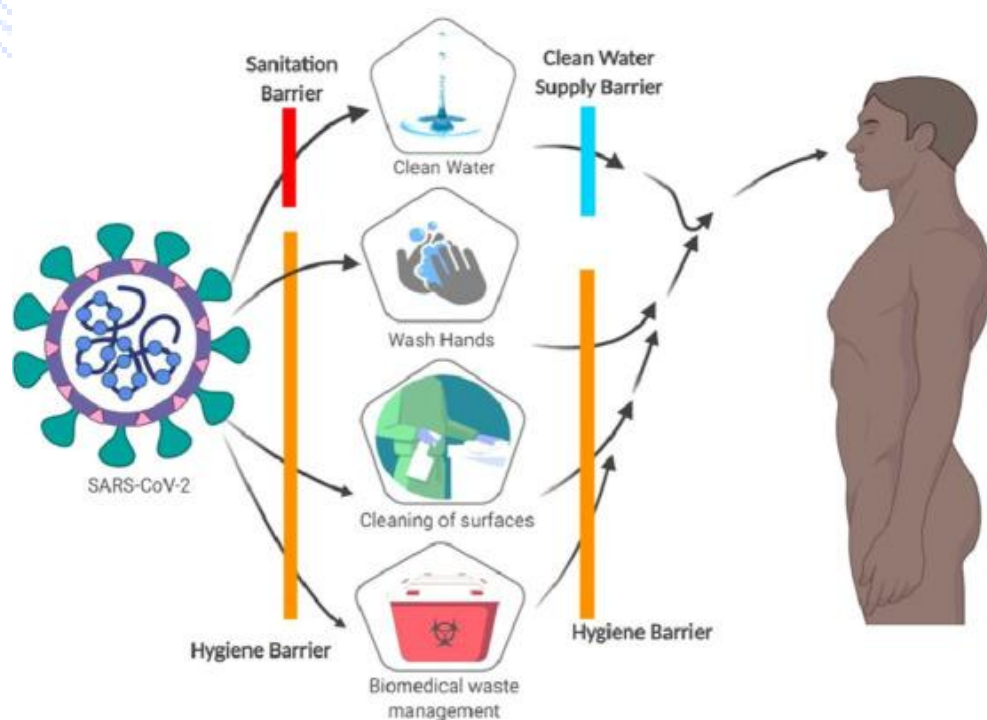
We know the virus is transmitted through direct contact with respiratory droplets of an infected person through coughing and sneezing, and touching surfaces contaminated with the virus. The virus may survive on surfaces for a few hours up to several days. Taking necessary precautionary measures will help

us to fight the deadly virus. Precautionary measures such as use of masks, maintaining social distance norms and sanitizing hands and should be strictly followed.

Covid-19 case numbers and deaths were exponentially rising in India. We all have seen how effectively our corona warriors have fought the battle. The second wave was too powerful and the number of cases in a single day stretched our health community badly. Though, the cases are now in control but we are not in that environment where we can live like the normal days. This is the time when we all need to come together and have a spirit by doing our bit in fighting against the disease. Have we ever questioned ourselves, why the second wave took this drastic shape? This happened because of not having the right attitude, taking the virus as a normal flu, not wearing the mask properly. When the cases came drastically down in January, people thought that the virus has gone and this resulted the spike in the cases. As a responsible citizen, we need to understand that our focus should be on maintaining personal hygiene not only for ourselves, but for others also. Wherever we go, we should sanitize the area properly, maintain social distance, and wash our hands properly to win the war against the deadly virus. Keeping in mind the situation many brands stood up and launched products in hygiene and safety category at affordable prices.[7,8]

The main purpose is to prevent UTI, which is becoming a common concern among women. The infection involves greater risk when one uses public washrooms that are often unclean and unhygienic. Apart from Toilet seats and toilet tops it is important to spray the disinfectant on flush, faucets, door knobs and other hard surfaces to avoid the chances of getting infected. Increase in COVID- 19 cases saw a spike and this generated a surge in the requirement of masks, sanitisers and other COVID products as well. The pandemic has caused tremendous disruption to the lives and work processes. Irrespective of how severely or mildly it affects a person, it is still capable of wreaking havoc with our physical and mental fitness and ability to perform various tasks. In such a scenario, using hygiene and sanitation products and adhering to cleanliness can keep us safe from illness. People are requested to take utmost care of themselves by using mask, sanitisers and break the COVID- 19 chain which is a duty of every citizen and don't take safety for granted. [9,10]

Possible WASH interventions to prevent SARS-CoV-2 transmission



Results

The world is facing a pandemic in the form of the COVID-19 outbreak. In this situation, one cannot be sure about the authenticity of information coming their way. And in today's time where information exchange is rampant, it can lead to a ton of questions about which method to use for disinfection and sanitization against COVID-19. The only thing that can assure the masses in these grave times is education towards the prevention of COVID-19. Take a look at the following disinfection and sanitization tips that will help win the battle against the novel Coronavirus.[11]

Coronavirus Prevention Tips:

The COVID-19 virus is claiming thousands of lives around the globe. In this grave situation, prevention is better than cure. Take a look at the following prevention tips:

1. Use Masks When Required:

Ever since the outbreak of the novel Coronavirus, major change in daily lives is people wearing masks. Everywhere you go, you will see people using all sorts of masks that come in various shapes and colors. There are broadly two types of masks which can protect you against the possible transmission of COVID-19:

- N95 respirators: These are usually circular or oval in shape and are capable of filtering out nearly 95% of particles from the air.
- Surgical masks: A surgical mask loosely covers the nose, mouth and the chin area. It limits the expulsion of particles from the wearer into the surrounding area.

According to the recent guidelines issued by the Ministry of Health & Family Welfare, Government of India, every one need not wear a mask. The use of masks should be prevented unless you are in any of the following situations:

- ✓ You are actively coughing or sneezing
- ✓ You are taking care of a person suspected of or infected by the coronavirus
- ✓ You suspect that you are infected

If you intend to use a mask, you should take proper measures for the use and disposal of a mask. Clean your hands with an alcohol-based solution or soap before handling a mask. Wear a mask by properly covering your nose, mouth, and chin. Also, avoid touching the mask while wearing it. Every type of mask cannot be reused, if you are using a disposable one discard it after one use. To dispose of a mask, throw it in a covered waste bin and wash your hands thoroughly.

2. Maintain a Distance of Atleast 3-6 Feet if You Step Outside:

The Indian government has been urging the public to stay indoors and avoid going out unless absolutely necessary. People are advised to stay indoors. These measures are an excellent step towards curbing the spread of coronavirus and breaking the chain of transmission.

When you are required to go out of the house in this situation, make sure that you maintain a distance of at least 3-6 feet between you and other people. This is because the COVID-19 virus can be sprayed into the air from an infected person via small droplets while coughing or sneezing. There is a very high risk of infection if you breathe this air.[12,13]

3. Care for Your Respiratory System:

According to the WHO, the early symptoms of COVID-19 are dry cough, nasal congestion, runny nose, sore throat, tiredness, fever, etc... Thus, the COVID-19 virus mainly affects the respiratory

system of a person. Coughing and sneezing are also the primary means of transmission of coronavirus. Thus, it is of utmost importance that you take care of your respiratory system and maintain its hygiene.

To have a healthy respiratory system avoid smoking. Do not go out of your way to find means of smoking when it is unavailable in these times. Quit completely. Revitalize your respiratory health by practicing breathing exercises and yoga. These will improve your overall health as well. Drink the recommended amount of water as per your age. Eat a healthy diet and wash your hands frequently.

4. Avoid Touching Your Eyes, Nose, Mouth:

There are chances that you might have picked up the virus from a contaminated surface. If you frequently touch your nose, eyes or mouth, you are accidentally transferring the virus to your body. Thus, it is advised that you avoid touching your eyes, nose, and mouth without thoroughly washing your hands.

5. Strictly Follow Rules and Government Advises:

While other countries and the World Health Organization have praised the efforts of the Indian government for battling the novel Coronavirus, it is our moral duty to follow the rules and advice issued via public platforms. This is the only way to help us remain healthy and free from the COVID-19 virus. Here are a few advice issued by the government of India:

1. Stay indoors unless for an emergency situation
2. Maintain personal hygiene. Wash your hands regularly with soapy water
3. Maintain social distancing
4. Do not forward news or facts about Coronavirus unless it is issued from an authentic source
5. Do not panic

Disinfection and Sanitization Tips Against COVID-19:

Apart from maintaining hygiene and following the prevention tips given above, one can also carry out the process of disinfection and sanitization to reduce the chances of contracting the COVID-19 virus. Here are a few tips:

1. For office spaces and apartments, one should consider decontaminating entrance lobbies, escalators, elevators, corridors and staircases, security guard booths, etc... Mop these surfaces using 1% sodium hypochlorite or phenolic disinfectants for this purpose.
2. Metallic surfaces should be cleaned with 70% alcoholic solutions. These surfaces may include security locks, keys, machines, etc...
3. Areas that are touched frequently should be cleaned at least twice a day. These areas may include elevator call buttons, intercom systems, tabletops, chair handles, dispensing machines, handrails/handles, etc... Dip a cloth in 1% sodium hypochlorite and wipe the area.[14,15]

Additionally, consider installing a sanitizing station for visitors. It is advised that surroundings should be disinfected as frequently as possible. Proper protection should be used while handling chemicals and while disinfecting the surroundings.

Conclusions

Disinfectants and sanitizers are essential preventive agents against the coronavirus disease 2019 (COVID-19) pandemic; however, the pandemic crisis was marred by undue hype, which led to the indiscriminate use of disinfectants and sanitizers. Despite demonstrating a beneficial role in the control and prevention of COVID-19, there are crucial concerns regarding the large-scale use of disinfectants

and sanitizers, including the side effects on human and animal health along with harmful impacts exerted on the environment and ecological balance. The roles of disinfectants and sanitizers in the control and prevention of the current pandemic and highlights updated disinfection techniques against severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Scientists provide evidence of the deleterious effects of disinfectants and sanitizers exerted on humans, animals, and the environment as well as suggest mitigation strategies to reduce these effects. Additionally, potential technologies and approaches for the reduction of these effects and the development of safe, affordable, and effective disinfectants are discussed, particularly, eco-friendly technologies using nanotechnology and Nano medicine. [16]

Employers, workers, and their organizations should collaborate with health authorities to prevent and control COVID-19. Cooperation between management and workers and their representatives is essential for workplace-related prevention measures. International labour standards on the rights and responsibilities of workers and employers in occupational safety and health should be fully respected.

Employers, in consultation with workers and their representatives, should plan and implement measures to prevent and mitigate COVID-19 at the workplace through engineering and administrative controls, and provide personal protective equipment and clothing according to the risk assessment. Such measures should not involve any expenditure on the part of the workers.

Special measures are needed to protect workers at higher risk of developing severe disease, such as those age 60 and over, or with underlying medical conditions, upon recommendation of the occupational health services. Workers in the informal economy and digital labour platforms, those in small enterprises, domestic and migrant workers should not be left behind in the protection of their health and safety at work and their livelihood. [17,18]

There should be no social stigma or discrimination at the workplace for any reason, including access to information and protection from COVID-19, occupational health services and mental health and psychosocial support.

If COVID-19 is contracted through occupational exposure, it could be considered an occupational disease and, if so determined, should be reported and compensated according to the international labour standards and the national schemes for employment injury benefits.[19,20]

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